Standard Lead Roll Sizes and Thickness

Table 1: Rolled Lead Sheet Theoretical Weights Chart/KG

Width (mm)	Nearest Imperial (inch)	Code 3		Code 4		Code 5		Code 6		Code 7		Code 8	
		3m	6m	3m	6m	3m	6m	3m	6m	3m	6m	3m	6m
150	6	7	13	9	18	11	23	14	27	16	32	18	36
180	7	8	16	11	22	14	27	16	32	19	39	22	43
210	8	9	19	13	26	16	32	19	38	23	45	25	51
240	9	11	22	15	29	18	37	22	43	26	51	29	58
300	12	13	27	18	37	23	46	27	54	32	64	36	72
360	14	16	32	22	44	27	55	32	65	39	77	43	87
390	15	18	35	24	48	30	59	35	70	42	84	47	94
450	18	20	40	28	55	34	69	41	81	48	96	54	109
510	20	23	46	31	62	39	78	46	92	55	109	62	123
600	24	27	54	37	73	46	91	54	108	64	129	72	145
760	30	34	68	47	93	58	116	69	17	81	163	92	184
800	32	36	72	49	98	61	122	72	144	86	171	97	193
850	34	38	76	52	104	65	130	77	153	91	182	103	205
914	36	41	82	56	112	70	139	82	165	98	196	110	221
1000	39	45	90	61	122	76	152	90	180	107	214	121	242
1200	48	54	108	73	147	91	183	108	216	129	257	145	290
1600	63	72	144	98	196	122	244	144	288	171	343	193	386
2400	96	-	-	147	294	183	366	216	433	257	514	290	580
Thickness (mm)		1.32		1.80		2.24		2.65		3.15		3.55	
Kg/m²		14.97		20.41		25.40		30.05		35.72		40.26	

All theory weights are subject to BS EN 12588:06 (manufacturing tolerance of ± 5%), and calculated by: length (m) x width (m) x kg/m²

Table 2: Heavier Rolled Lead Sheets

Code	Thickness	Weight m²
Code 9	3.81	43.20 kilos
Code 10	4.23	47.96 kilos
Code 11	4.89	55.45 kilos
Code 12	5.08	57.60 kilos

2.2.3 Traditional Sand Cast Lead

The oldest form of manufacturing lead sheet has changed little since medieval times and is used extensively in renewing the roofs of historic buildings when existing lead coverings can be stripped and sent to the casting company for recasting into new lead sheet for replacement.

Sand cast sheet is made on a large sloping table on which a bed of casting sand is first carefully prepared with every effort made to remove any blemishes which may affect the surface. Mounted at the upper end of the table is a large pot in which scrap or ingot lead is melted.

At the critical moment the molten lead is poured on to the sand bed and flows down the table, quickly followed by the casting operatives who skim the lead with a timber “strike” which is pre-set to achieve the thickness required. Excess molten metal is collected at the end of the bed to be re-used. The entire process is completed by trained and experienced casters with the skill to prepare the sand bed, the molten lead and the skimming of the cast to achieve the required thickness of sheet.

The traditional sand cast method cannot produce lead sheet to the same strict thickness tolerances as rolled lead sheet produced to BSEN12588. However, because of its historic use and focus on the heavier thicknesses (Code 6 upwards) sand cast sheet is widely used in the heritage sector and often the lead to be replaced is removed from site, melted and re-cast as new product and then returned to the roof it was taken from.

Sand cast lead sheet retains its crystalline grain structure and is easily recognised by one side (the skimmed upper surface) having a smooth mottled finish and the other best described as “orange peel” texture where it was in contact with the sand bed. The sheet can be laid either way but normally the smooth side is laid face up.

Traditional Cast Lead sand side finish

Traditional Cast Lead topside finish

2.2.4 Machine Cast Lead

Producing lead sheet by the “Direct Manufacture” (DM) method is a modern development from a process which was initially introduced in the UK in the 1970’s and can produce code 1-8 thickness lead sheet for construction, radiation protection and sound attenuation purposes.

Clean lead scrap (lead pipes, old sheet lead) is melted in a large pot (kettle) and impurities removed as they rise to the surface. Once this refining process is complete other elements are added (copper, tin, antimony) to add tensile strength to the finished product and aid its suitability for roofing work. The finished product is 99.9% pure lead.

The molten lead is pumped into a bath and then a water-cooled drum is lowered to the surface of the molten metal. The molten lead solidifies on the cold surface of the drum as it rotates and is lifted from the bath in a continuous sheet form which is then wound onto a coiler. Up to 6 tonnes can be coiled in a single process.

The thickness of the lead skimmed from the bath is determined by the speed of rotation of the drum and the depth of its immersion in the bath.

The lead sheet is then wound from the coil and cut into rolls as required. Standard thicknesses and roll widths are provided and the rolls are colour coded the same as for rolled lead sheet.

Unlike lead sheet manufactured to BSEN12588 the DM end product is not generic and each manufacturer produces their own version which is regulated through the British Board of Agrément (BBA) who issue a certificate to the manufacturer.

Direct machine cast lead manufacture and coiled

Machine cast lead retains its crystalline grain structure through the manufacturing process. Every roll of lead is weighed throughout the production process to ensure it meets the +/- 5% tolerance.

2.3 Product Specification and Manufacturer Warranties

2.3.1 Rolled

Rolled lead sheet is manufactured to BS EN 12588 for building purposes which defines the manufacturing process (lead sheet formed by the roll deformation process) as well as regulating thickness tolerances and chemical composition of the finished metal. Most significantly, the thickness tolerance of the finished sheet must not vary from the theoretical by more than +/- 5%. Most rolled lead sheet production is fully automated and computer controlled in order to achieve the fine tolerances required and manufacturers offer a 50 year performance warranty for their product.

2.3.2 Sand Cast

Traditional sand cast lead is almost entirely a manual process, considered as an Artisan trade which has been sympathetically mechanised, with scrap material forming the bulk of the feedstock and often reprocessing reclaimed lead from historic properties which is to be returned to the original site. It is not produced to any recognised manufacturing standard.

The finished product is therefore not metallurgically uniform and nor can the thickness be controlled to within the fine tolerances achieved by rolled lead sheet. However, the majority of the end product is produced in the thicker codes approximating to Code 6 (2.65mm) and above and historically has a proven long term performance record.

Manufacturers do not offer performance warranties for the sand cast product and the installer should check the consistency of the surface appearance as much as possible before installing.

2.3.3 Machine Cast

Machine Cast lead manufacturers offer a British Board of Agrément BBA certificate for their product. There is no generic stipulation regarding feedstock or the chemical composition of the finished product, which is determined by the individual manufacturer.

BS EN 12588 governs lead sheet formed by the roll deformation process and therefore this cannot include Machine Cast lead which is manufactured by an entirely different process. Manufacturers offer product warranties of 60 years.

2.4 Characteristics and Supplementary Data

2.4.1 Natural Patination

Lead sheet, like many other metals forms a protective surface or patina when exposed to air and moisture. This takes a period of time to form and in the short term unsightly white deposits appear to stain any new lead as soon as it has been subjected to moisture contact

These white deposits will be naturally washed off by rainfall and installers should be aware that in some cases this may cause staining of interfacing roofing and building materials by run off into areas directly below where the new lead is installed.

The natural patination process can be mitigated by the use of patination oil ***(see page 14)*** until carbon dioxide and other pollutants in the atmosphere react with the lead over time and form a natural protective coating of basic lead carbonate and oxide.

Installers should be aware that if the lead is wet on the underside when it is laid and the internal roof space is not properly ventilated, then the white carbonate will be neither dried nor washed off and so may initiate the underside corrosion of the lead sheet. It is therefore imperative that adequate ventilation is designed into the substrate ***(see Chapter 11)***.

2.4.2 General Properties

Table 3: General Properties of Lead	
Atomic weight	207.2u
Atomic number	82
Density	11.34 g/cms^3
Coefficient of Linear Expansion	0.0000297 per °C
Thermal Conductivity	34.76W/m °C
Melting Point	327.4 °C

2.4.3 Malleability and Strength

The workability of lead is due to its malleability and in its refined form can be manipulated and worked into complex shapes by using bossing techniques and hand tools by the skilled Leadworker. Although this can normally be undertaken in any temperature, for thicker lead sheets in colder winter weather temperatures, gentle warming of fold lines will assist in the folding or bossing process. Sheet Lead will not work harden as other metals.

As lead is such a malleable metal, it has little rigid strength and must therefore be properly supported, The fixing, sizing and procedural specifications provided in this Guide to Best Practice are designed to provide the installer with the information to correctly lay the lead sheet, but the substrate on which it is laid must be fully supportive of the soft metal.

The key to the long term performance of the product is to provide secure fixing whilst at the same time allowing for the natural thermal movement that will result from exposure to temperature changes, including mitigation of the “creep factor” where gravitational influences prevent the lead from fully contracting after thermal expansion.

2.4.4 Thermal Movement

The installer must always take into account the effect of thermal movement when lead sheet is being used as a roofing or cladding material.

At 50°C, (a temperature easily achieved through the effect of direct sunlight on metal) a 2m panel of lead sheet could move as much as 6mm.

The coefficient of linear expansion for lead is 0.0000297 for 1ºC. Therefore a temperature variance of 50ºC on a 2m panel results in a calculation of 2m x 50 x 0.0000297 = 3mm expansion (+ 3mm of

8.12.6 Saddle Pieces

If the chimney straddles the ridge, then saddle pieces are needed as described on *page 59, D57*.

8.12.7 Chimney Flashings and Damp Proof Courses

Chimney flashing's are installed to prevent water entering the roof were the chimney structure penetrates the roof structure and roof coverings. The chimney damp proof course (DPC) is a moisture proof layer that is set within the chimney structure. It is located to prevent external wind driven precipitation entering the chimney masonry and penetrating down the chimney structure where it could cause dampness and masonry deterioration within the internal occupational areas of the building.

The Architect or Designer of the building must give clear instructions to the DPC Installer as to the exact requirements required as to the chimney DPC location and penetration depth of the chimney construction ensuring that the DPC will not penetrate the flue liner and that the relevant Building Regulations, British Standards and the Flue liner Manufacture recommendations are adhered to. The prevention of flue gasses escaping into a building is a statutory requirement of Building Regulations.

When historical chimneys are rebuilt with or without flue liners, the Architect or Designer must ensure that all regulations are adhered to when instructing the DCP Installer to prevent the escape of flue gasses into the structure.Further advice can be obtained from The National Association of Chimney Engineers (NACE). www.nace.org.uk

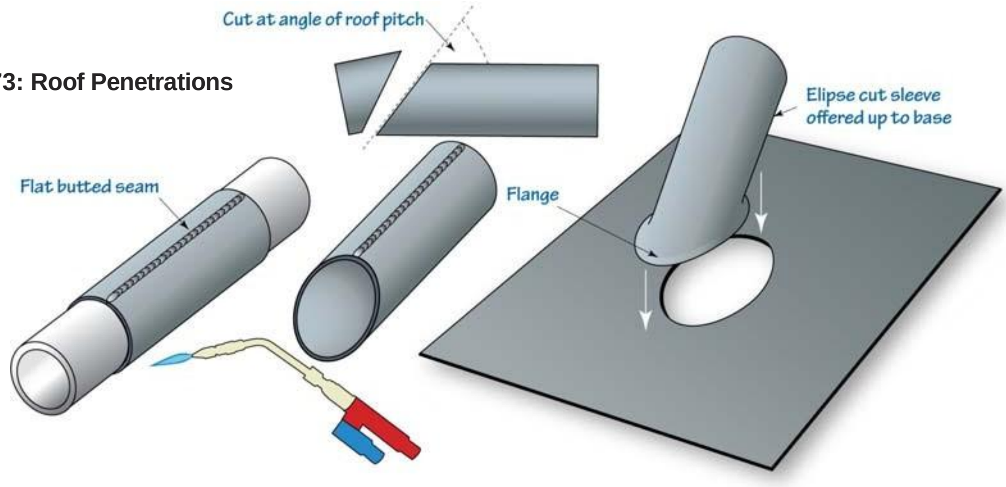
Historically lead was used to form DPC's due to its flexibility in use but there are now several proprietary materials that can be used to form a DPC. However, if lead is used then it must be painted with bitumen paint on all sides to protect it from new mortar alkalis.

8.13 Lead Slate Flashing for Roof Penetrations

The use of a "lead slate" for flashing is historical terminology and originated from when lead was used to weathering roof penetrations through the courses of a slated roof. Today the term is used for any lead weathering of any smaller penetration of a roof covering.

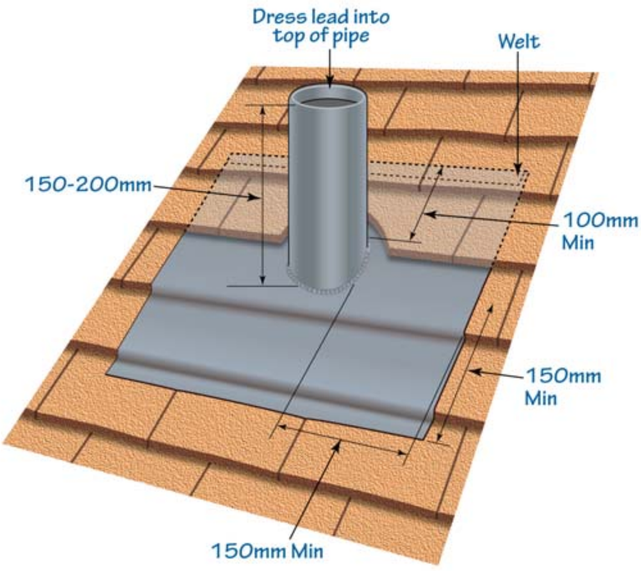
The weathering of pipe penetrations is the most common and the slate is normally more economically produced when welded but slates can also be bossed. The size of the base depends on the type of roof covering and pipe diameter. For standard tiles and slates with 100mm diameter pipe penetration, a base width of 400mm should be sufficient. There should be a covering of a minimum of 150mm in front of the pipe upstand and an under lap of a minimum of 100mm with a back welt under the slates or tiles at the rear of the pipe upstand. With single lap tiles it may be prudent to increase the side width to 200mm on each side of the pipe to allow dressing to profiles. Lead slates can be made on site, prefabricated or simply purchased from local outlets ready made to standard sizes and most roof pitches. Code 4 is the minimum thickness lead to be used.

D73: Roof Penetrations

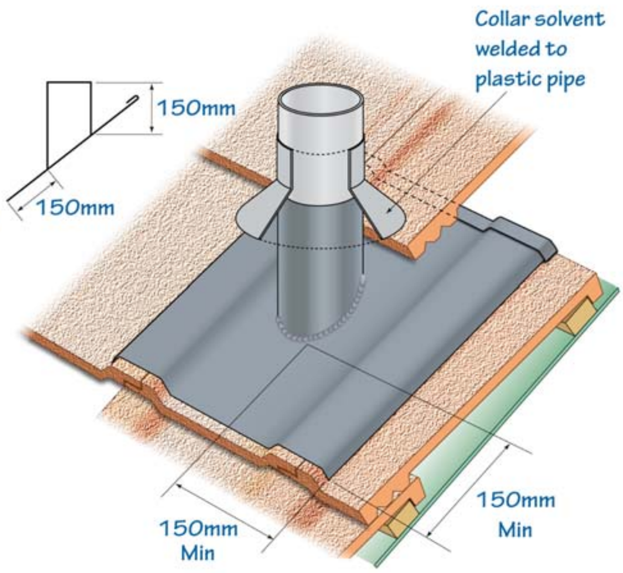


To produce a lead slate, a piece of lead wide enough to allow for the required height of the upstand plus an allowance for the weathering turn-in to the top of the pipe if required. The lead is then cut in length to allow for the external diameter of the pipe to be used, allowing a further 5mm for tolerance. The upstand is dressed around a piece of the pipe to be used and the meeting edges flat butt welded together *D73*. The Sleeve is trimmed to form the correct roof pitch and bossed to form a narrow flange. The sleeve is then positioned on the base and the hole is marked and then cut out from the base plate. The pipe sleeve is then welded to the base using a flat lapped weld.

D74: Leadwelded Lead Slate to a Cast-Iron Pipe



D75: Leadwelded Lead Slate to a Plastic Pipe



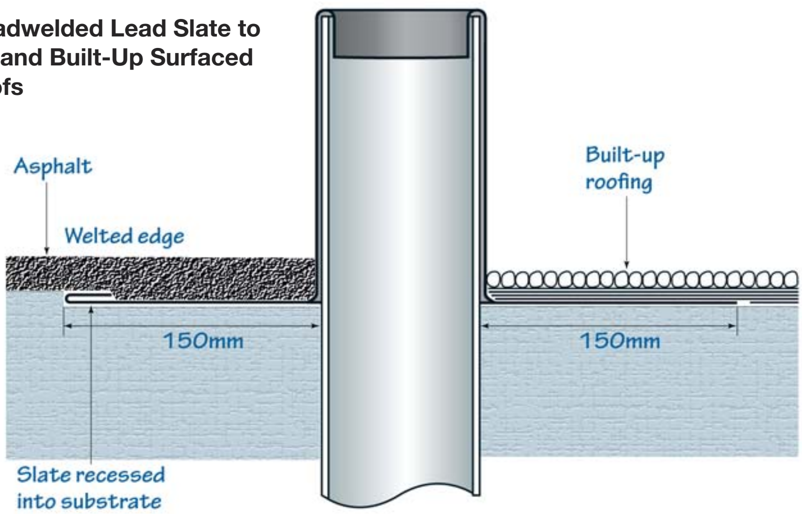
The weathering of the sleeve upstand is important, ***D74*** **and** ***D75*** give two examples. Where the lead sleeve is required to be dressed to the top of a cast iron ventilation pipe, this should be done by an experienced leadworker. For upstands above 300mm cast iron collars or fittings can be obtained. A plastic cravat or collar would be expected to be fitted by a plumber or experienced roofing operative. Other upstand sleeves may require bespoke methods (e.g. a suitable lead mastic seal), but regardless of the method used, the top of the sleeve must be made watertight.

When there is a pipe penetration through a flat or sloping lead roof, the lead upstand sleeve can be welded directly to the lead covering.

Lead slates for pipe penetrations are popular with membrane and asphalt roofs and examples are shown in ***D76***.

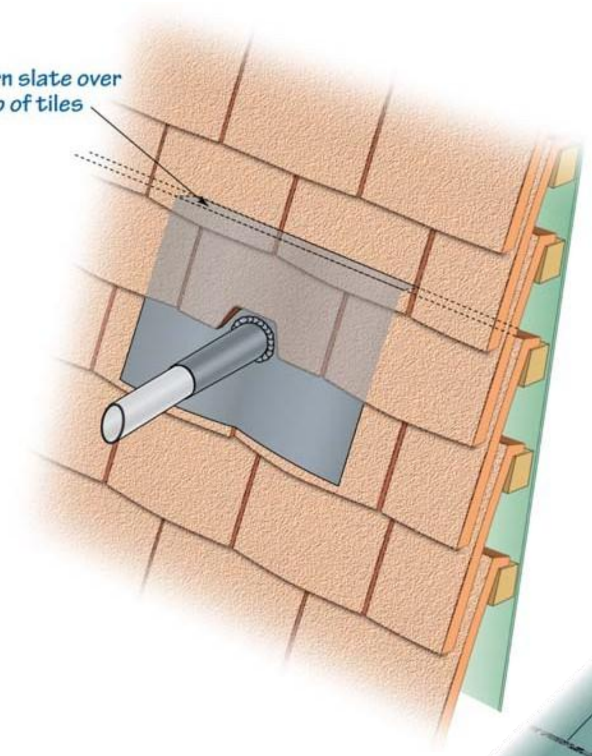
The lead slate must be bonded into the roof covering according to the manufacturer's recommendations.

D76: Leadwelded Lead Slate to Asphalt and Built-Up Surfaced Flat Roofs

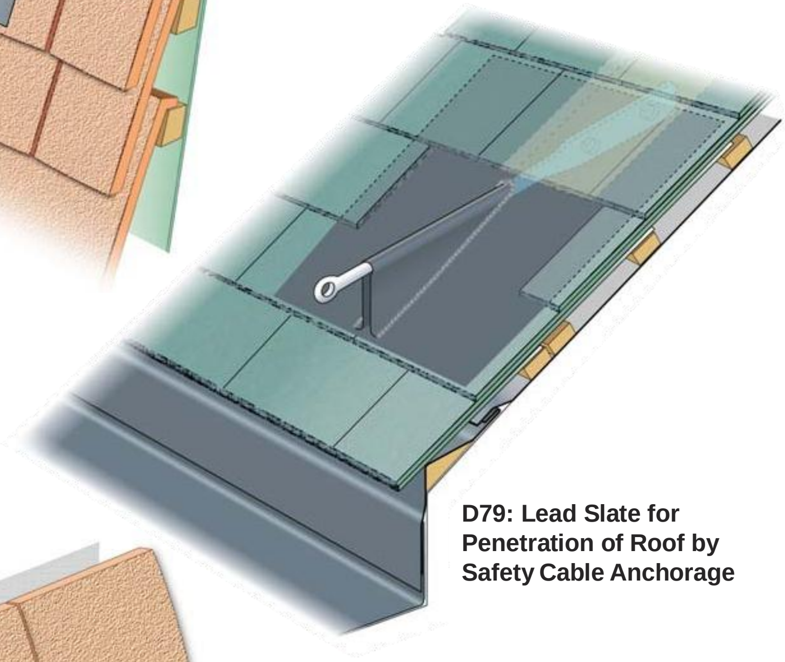


The requirement for the weathering of roof penetrations is extensive and includes providing for overflows, fixing blocks, Solar panel supports, safety cable anchorages, cable entries and ventilators. In most cases the type and design of weathering should be decided by the installer to suit the type of penetration, the roof covering and the roof pitch. In addition, where the penetration is through a lead covered roof, the location and the allowance for thermal movement must be also be taken into consideration.

D77: Lead Slate to Overflow Pipe

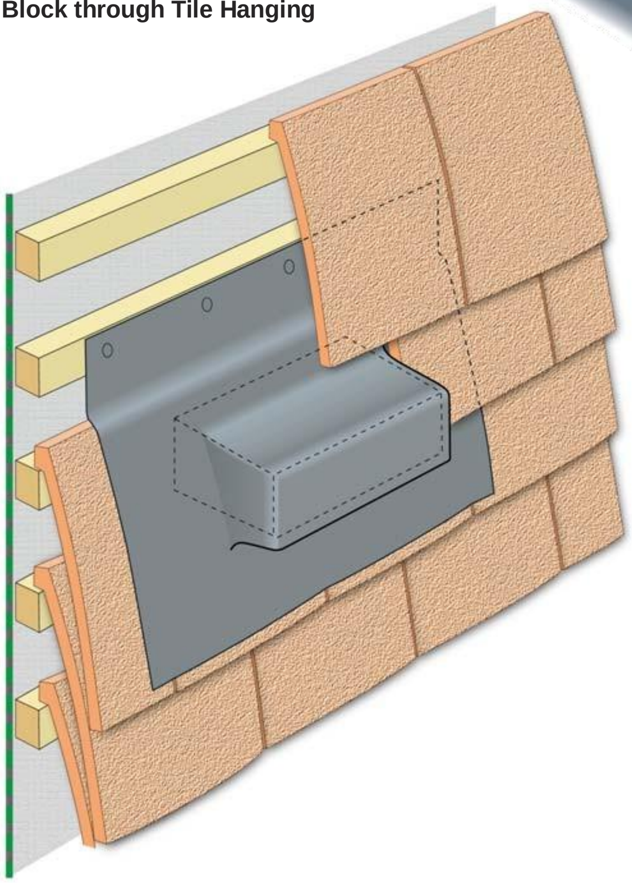


Lead Ventilator Penetration



D79: Lead Slate for Penetration of Roof by Safety Cable Anchorage

D78: Lead Flashing to Fixing Block through Tile Hanging



Pedestal support should be used to support all Solar arrays and Plant Equipment with a minimum of 150mm clearance of the lead coverings. The pedestal structural or block must be lead-weathered with an allowance of a minimum 10mm gap to allow for thermal movement. Supports resting on the lead covering are not recommended.

The weathering of specific penetrations can often be prefabricated on the bench.

8.14 Flashings to Vertical Tile and Slate Cladding

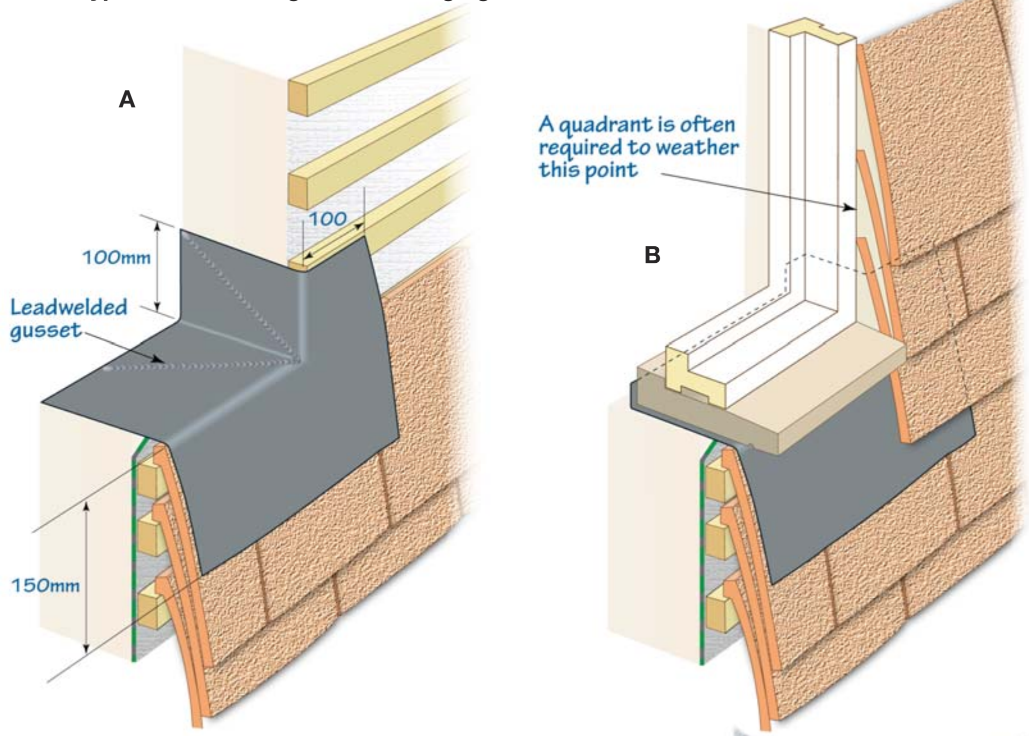
Slate and tile vertical cladding to buildings can be found in both housing and commercial developments and using lead to weather in windows and abutments is both a practical and flexible method.

8.14.1 Window Flashings

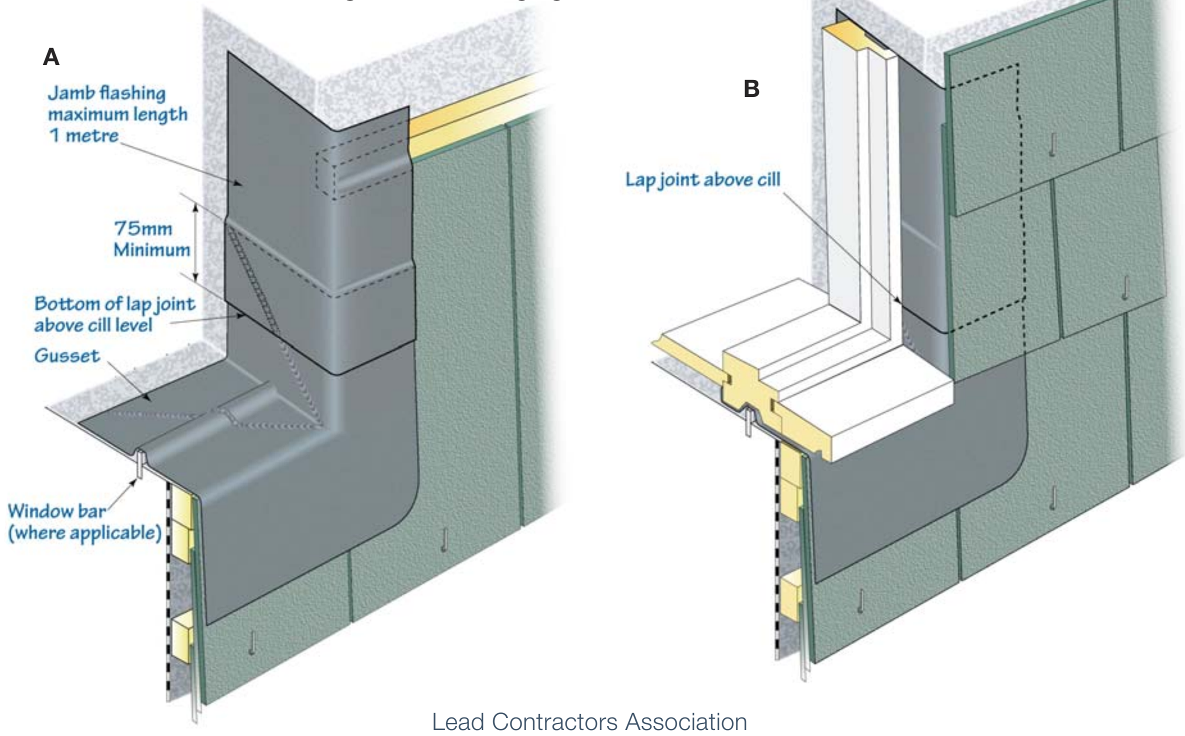
The window opening is weathered with a lead apron to the underside of the projecting window sill *D80-A* shows the corner detail finishing over tiles. The corner can be bossed or welded with a gusset. ***D80-B*** shows the window frame fixed in position and whether wooden or plastic, the frame must be carefully sealed to ensure full weather protection.

Where the window is set back from the face of the hanging slates or tiles, a jamb flashing will be required to prevent water entering behind the corner upstand ***D81-A*** and ***B*** illustrates this detail. The corner sill upstand and the window jamb flashing lap is located above the window sill to avoid any thermal movement restriction.

D80: Typical Sill Flashings in Tile Hanging



D81: Sill and Jamb Flashings in Slate Hanging



CHAPTER 11 - SUBSTRATE DESIGN

11.1 Corrosion – The Chemical Influence

Lead sheet will corrode and eventually fail if not installed correctly. However, even lead sheet correctly installed may still corrode and fail if the supporting substrate on which it is fitted is inadequate or incorrectly designed.

The top surface of lead sheet which is exposed to the elements will form a natural protective patina over time which prevents corrosion. The patina is created by the formation of insoluble salt on the sheet which is then affected by the natural moisture and carbon dioxide in the atmosphere combining to form a weak carbonic acid. This coating reacts with the bright surface of the new lead sheet and dulls it to a natural weathered grey which then protects the top surface of the lead from further corrosion by the elements.

This natural weathering does not automatically occur on the underside of the lead sheet which can corrode in several ways, the most common of which is by attracting moisture from either a damp substrate or from warm air rising from the inside of the building and condensing in thick layers on the underside of the colder metal.

The main corrosive element is white Hydrocerussite also known as white lead (2pbCO3pb(OH)2), although this can also be in the form of a red or yellow oxide (PbO) normally referred to as Massicot and Litharge if carboxylic acids (acetic or formic) are present, perhaps from using an inappropriate timber (e.g. oak) in the supporting substrate.

In each case the corrosion occurs because carbon dioxide is not present in sufficient quantities to dispel the moisture from the surface of the lead and instead it combines with the lead hydroxide which has migrated to the surface of the moisture (as opposed to the surface of the lead) where it forms the Hydrocerussite. Because this has formed on the surface of the moisture it remains loose and subject to further corrosion.

A key consideration to minimise the risk of underside corrosion is therefore the design of the substrate which is provided to support the lead sheet.

11.2 The Substrate Construction

There are various situations which require consideration of the supporting substrate for lead sheet

a) A new construction where the designer can provide a compatible substrate from new without needing to take into account existing structures and features.

b) An existing structure which has previously had lead coverings without any significant underside corrosion

c) An existing structure where lead coverings have failed and need replacing, or further lead coverings are to be added to the existing.

d) A change in the building, e.g. a requirement to increase the thermal insulation of the roof to reduce heat loss.

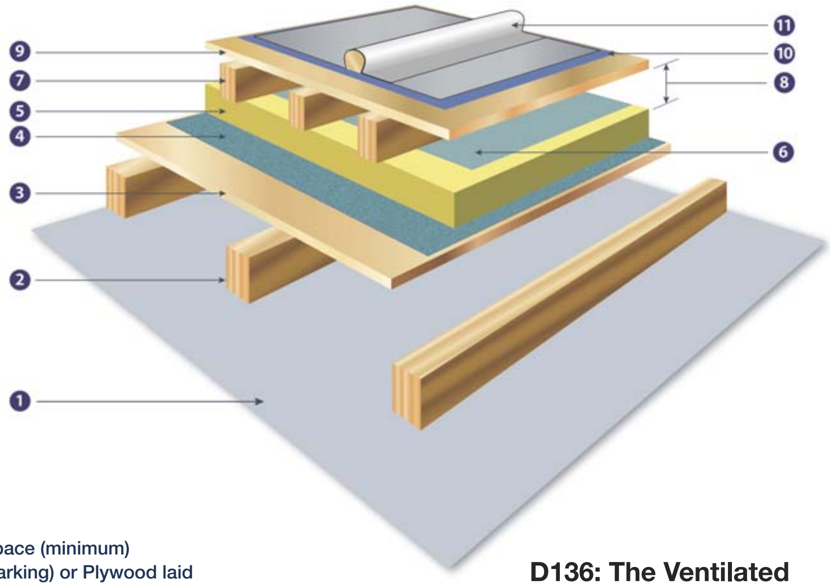
e) Non-combustible constructions over 18m in England Wales, and Northern Ireland, 11m in Scotland must conform to Building Regulations 2010, Fire Regulations, Approved Document B Volumes I and 2.

11.3 New Construction Substrate Design

The substrate design for new constructions should consider both current and potential future use. The objective should be to minimise the amount of warm air and moisture rising through the roof structure from activities within the building; this is particularly the case with kitchens, bathrooms, utility rooms and the associated heat and moisture generated.

A prime consideration must be the introduction of adequate ventilation to the underside of the lead coverings to deal with the condensation that could occur. Ventilation will introduce the important element of carbon dioxide to the underside of the lead coverings and prevent the Hydrocerussite from forming. The use of warm roof constructions where there is no ventilation below the lead covering is not acceptable in most circumstances.

11.3.1 The Ventilated Warm Roof



1. Interior finish
2. Rafters
3. Supporting Plywood sub deck
4. Vapour barrier (VB)
5. Insulation
6. Breather Membrane
7. Battens
8. 50mm ventilated air space (minimum)
9. Softwood boarding (Sarking) or Plywood laid with 3-5mm gaps (minimum 18mm thick)
10. Underlay (if required)
11. Lead coverings

D136: The Ventilated Warm Roof

The ventilated warm roof construction is a substrate design increasingly being used for new lead roofs.

The supporting plywood subdeck ***(3)*** allows the vapour barrier ***(4)*** (specification for roofs is EN 13859-1) to also be fully supported, enabling it to be sealed air tight at laps and abutments. The vapour barrier (VB) must be fully sealed to any pipework or roof lights that penetrate the roof structure. This also applies to perimeter abutments.

The best vapour seal can be achieved by using a self-adhesive bitumen-backed aluminium foil vapour barrier, with a vapour resistance of 4000MN/sg compliant to BS SO 12572 which also has self-seal properties for fixings.

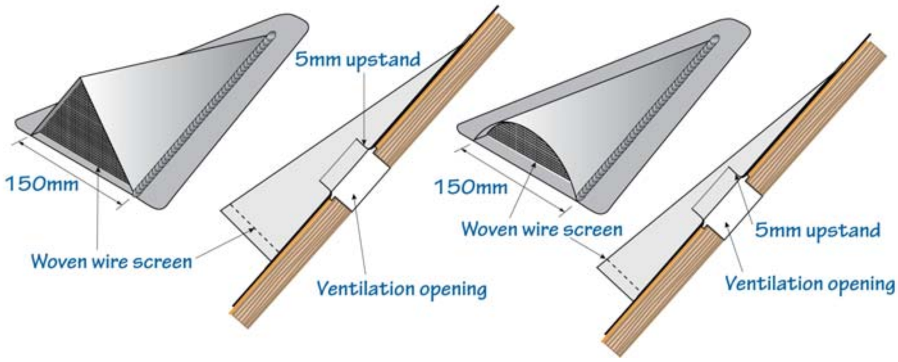
The insulation ***(5)*** must be ridged and supportive. It is advisable to cover the insulation with a breather membrane ***(6)*** (EN 13859-1) which will allow any residue moisture to pass through the membrane into the ventilation space where it is dispersed by the air movement created. The breather membrane also protects the insulation from moist air that is drawn into the ventilation space through the external roof eaves or ridge venting provision by certain weather conditions.

BS 5250-2011 defines the minimum ventilation void dimensions and the allowances that should be made to ensure adequate air ingress and exit. The minimum air space created should be 50mm with 25mm continuous gaps at the eaves and 10mm minimum either side of the ridge. For flat roofs (1^{o} to15^{o}) the air space should be increased to 80mm with suitably increased inlet and outlet dimensions.

The supporting boarding ***(9)*** above the ventilated space and under the lead coverings should be a minimum of 18mm thick and the recommended material is softwood boarding (sarking boards) to BS5268: part 2 (Class SC3) or EN1611-1:1999 laid with “penny washer” gaps, 18mm minimum plywood to BS EN 636-3 can also be used. The gaps in the boarding is to allow air movement to dry the underside of the lead and should be no more than 5mm for codes 5 & 6 or 10mm for codes 7 & 8.

During construction all timber and insulation must be kept as dry as possible and the moisture content of the boarding being used must not exceed 22%. During installation all boards and timber surfaces should be checked to ensure nails and screw fixings are sufficiently punched or counter sunk and do not protrude above the surface. Boards must be laid without any deviation greater than 2mm and corners of external angles should be well rounded. The timber must be well-seasoned and must be carefully cut to avoid cupping or distortion when laid. If the boards have been treated with preservative or fire retardant chemicals they must be allowed to dry fully before using.

D149: Site Manufactured Vents for Steep Pitches 30° and Above



Proprietary Manufactured Vents for Pitches 30° and Below

Using ventilators as a total alternative to providing eaves gap ventilation will not normally be practical due to the number required. They are also not as efficient and may be unsightly, however they do provide a useful option in areas where there is restricted opportunity for in air ingress or egress.

11.5 Other Measures to Protect Against Underside Corrosion

As well as providing adequate ventilation to the underside of a lead roof there are several further measures to minimise the risk of underside corrosion.

11.5.1 Chalk (Calcium Carbonate) Treatment of the Lead

The practice of chalking the underside of the lead sheet has been in use for several years and recent trials by Historic England have confirmed that controlling the pH of water and providing a source of carbonate will assist in the forming of the protective patina on new lead.

Historic England's "A Revised Advisory Note on Underside Corrosion 2017" is a recommended read for lead roofing installers and designers. The application of chalk emulsion is the preferred method, giving an even spread of chalk particles, avoiding the flaking which can occur when chalk is applied as a slurry. The application of chalk combined with building paper is acceptable.

Chalk emulsion coating to underside of lead after 3 years exposure

Chalk emulsion is available as a proprietary mix from manufacturers but can also be made using fine grade chalk powder which is mixed into thick non-drip (viscous) external emulsion paint (Historic England specifies ICI Weathershield or Mountshield) combining to form a fully saturated carbonate rich slurry. The proportions are 50-50-10 Chalk-Paint-Water. Lower cost / quality emulsion paints have been found to cause the chalk to separate from the paint during use.

The chalk emulsion should be applied to give a 150-200 micrometres thick coating. More coats may be required depending on conditions at the time of application, especially if the timber substrate is acidic and may emit organic acids during its lifetime. Such timbers would include sweet chestnut, Oak and various hardwoods also man-made boards containing resins or adhesives (some plywood and OSB particle boards).

The Chalk Treatment has a helpful mitigating effect against underside corrosion but it is not a replacement for a good ventilated roof.

11.5.2 Tinned Lead

Recently a manufacturer has introduced rolled lead sheet to BS EN 12588 with an added coating of tin to one side. The tinned lead sheet can be used and bossed exactly the same as uncoated lead without the tinned coating being affected and it is claimed by the manufacturer that the protection offered by this product is at least that of chalk emulsion. Further testing and evaluation is being carried out and it is advised that this product is treated as an additional aid and not alternative to the vented roof.

Bossed tinned lead details showing tinned face upwards

11.6 Non-Combustible Constructions

When using class A1 non-combustible board for fixing lead sheets it must be a minimum of 18mm thick and have a fixings pull-out values equal to that of 18mm thick plywood boards and be confirmed to be compatible with lead coverings.

CHAPTER 24 - SOURCES OF FURTHER TECHNICAL INFORMATION

British and European Standards , Codes of Practice and Regulations Relevant to Lead Roofing

BS EN 12588:2006 *The manufacture of Rolled Sheet lead.*

BS 6915:2001 *Code of Practice for Lead sheet roof and cladding installation.*

BS 6229:2018 *Flat roofs with continuously supported flexible waterproof Membrane Coverings.*

BS1521 *Class A Building paper.*

NBSC Specification Ref H71 *National Building Standards Company Specification for Lead.*

The Control of Lead at Work Regulations (2002) *Working with lead regulation*s.

Manual Handling Operations Regulations 1992 as amended in 2002 *Moving heavy weights.*

DIN EN 1172:2011 *Copper Sheet and Coil manufacture.*

DIN EN ISO 9445 parts 1-2:2010 *Stainless Steel Sheet and Coil manufacture.*

BS EN 1991-1-1:2002 Eurocode 1 *Actions on structures-General Actions-Densities, self-weight, imposed roof loads for buildings.*

NA to BS EN 1991-1-3:2003 UK National Annex to Eurocode 1 *Actions on structures-general actions-Snow Loads.*

BS EN 1991-1-4:2005 Eurocode 1 *Actions on structures-general actions-Wind.*

NA to BS EN 1991-1-4:2005 UK National Annex to Eurocode 1 *Actions on structures-general actions-Wind loads.*

BS 6399-1:1996 Loadings for Buildings-CP *for dead and imposed loads.*

BS 6399-2:1996 Loadings for Buildings-CP *for wind loads.*

BS 6399-3:1996 Loadings for Buildings-CP *for imposed loads.*

BS EN 7843-4:2012 *Guide for the estimation of areal rainfall.*

BS EN 12056.3:2010 *The design of correct roof drainage.*

BS 5268-2:2002 *Structural use of timber code of practice for permissible stress design materials and workmanship.*

BS 8103-3:2009 *Structural design of low-rise buildings-Code of practice for timber floors and roofs for housing.*

BS 5250:2011 *Code of practice for the control of condensation in buildings.*

BS EN ISO 13788:2012 *Hydrothermal performance of building components and building elements. Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation methods.*

BS EN 13970:2004 *Continuous aluminum foil backed bituminous self-sealing Vapour barriers.*

EN ISO 12944-2 *Corrosivity Classes for internal environments.*

BS 8414:2015 *Fire performance of external cladding systems part 1 or part 2+ A1- 2017 (BRE technical note on BS8414:2005 part 2 BR135).*

EN 13523-10/2010 *Product testing.*

EN 15523-3/2001 *Product testing.*

BS 1210 *British screw table sizes.*

BS 1202:1974/1-3 *Specification for nails.*

BBA Certifications

BBA Certificate 86/1764 *Midland lead directly cast Lead.*

National Building Regulations

The Building Regulations 2010 (England and Wales) (as amended). The Building (Scotland) Regulations 2004 (as amended).

The Building Regulations 2012(Northern Ireland) (as amended). Eire Building Control Acts 1990-2014 (as amended).

Fire Regulations, Approved Document B volumes 1&2 Building Regulations 2010.

SOURCES OF FURTHER TECHNICAL INFORMATION

Name & Address	Contact	Service
Organisations and Public Bodies		
An Taisce National Trust for Ireland Tailors Hall, Black Lane Dublin Ireland DO8 X2A3	W: www.antaisce.org E: Info@antaisce.org T: 00353 1454 1786	National Charity working to preserve Irelands built heritage
CADW Welsh Government Plas Carew Unit 5/7 Cefn Coed Parc Nantgarw Cardiff Cf15 7QQ	W: www.cadw.gov.wales E: cadw@gov.wales T: 0300 025 6000	Public Body for Historic Environment
Ecclesiastical Architects and Surveyors Association (EASA) **Thomas Ford and Partners** 177 Kirkdale London SE26 4QH	W: www.easa.org.uk E: matthew.newton@thomasford.co.uk T: 0208 659 3250	Ecclesiastical Architects
Historic England Conservation Team 1 Waterhouse Square 138-142 Holborn London EC1N 2ST	W: www.historicengland.org.uk E: london@HistoricEngland.org.uk T: 0207 973 3700	Public Body for Historic Environment
Historic Environment Division Department of Communities 1-7 Bedford Street Belfast County Antrim BT2 7EG	W: www.communities-ni.gov.uk E:historicenvironmentenquiries@ communities-ni,gov.uk T: 0289 082 9000	Public Body for Historic Environment
Historic Environment Scotland Longmore House Salisbury Place Edinburgh EH9 1SH	W: www.historicenvironment.scot E-mail: HMEnquiries@hes.scot T: 0131 668 8600	Public Body for Historic Environment
International Lead Association (ILA) Bravington House 2 Bravington Walk London N1 9AF	W: www.ila-lead.org E: enq@ila-lead.org T: 0207 833 8090	International Lead Organisation
National Association of Chimney Engineers (NACE) 3 The Pinfold, Digby, Lincoln LN4 3ND	W: www.nace.org.uk E: info@nace.org.uk T: 01526 322555	Controlled Fittings' (Chimneys & Flue Systems)
National Trust Heelis Kemble Drive Swindon SN2 2NA	W: www.nationaltrust.org.uk E:thesecretary@nationaltrust.org.uk T: 0179 817 400	National Historic Property Charity
Lead Contractors Association Centurion House, 36 London Road East Grinstead, West Sussex RH19 1AB	W: www.leadcontractors.co.uk E: info@leadcontractors.co.uk T: 01342 317 888	Lead Sheet in Roofing